EEE 313 - Lab 4 - Wideband Dual-stage BJT Amplifier
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1) Preliminary Recap:

In this lab, we designed a wideband two stage BJT amplifier. We also used a feedback loop to stabilise the gain. The circuit was designed to have a gain of 20dB.

It was observed that decreasing the values of R_4 and R_9 while preserving their ratio increased the corner frequency for high frequencies.

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2) Hardware Implementation:

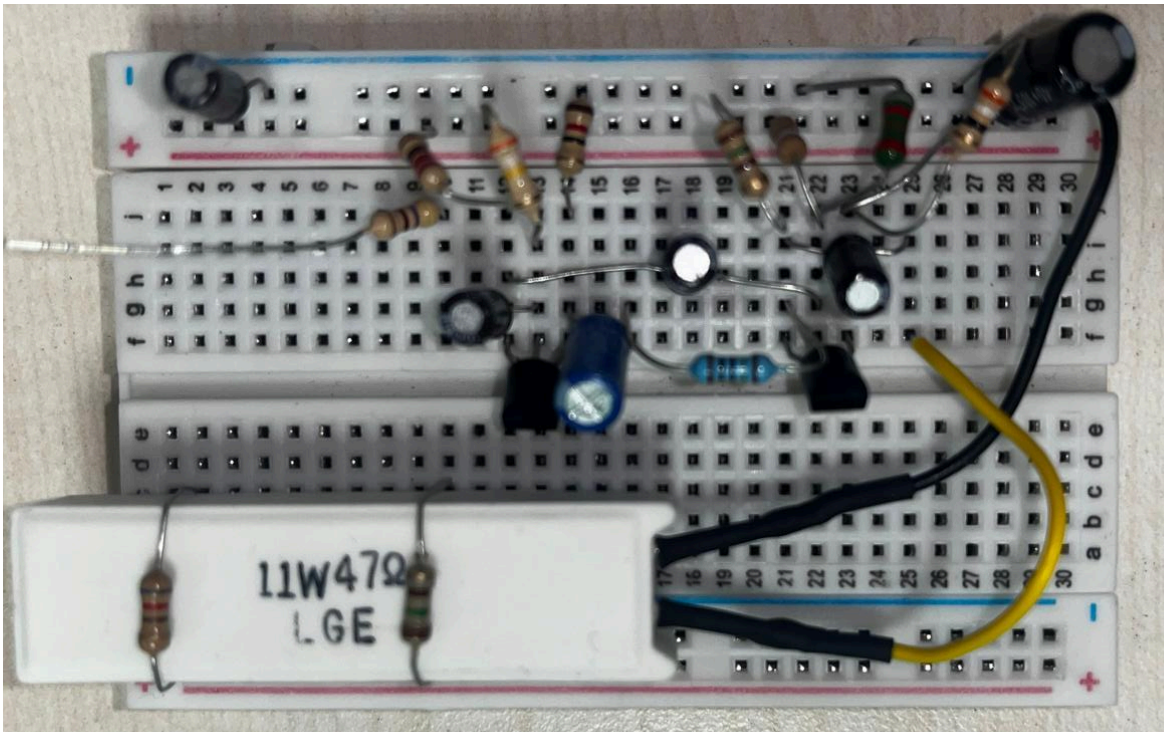

Figure 2: Circuit Breadboard Implementation

3) Component List:

- 1 x 470Ω
- 2 x 47Ω
- 1 x 390kΩ
- 1 x 12Ω
- 1 x 120Ω
- 1 x 3.9kΩ
- 1 x 150Ω
- 1 x 820Ω
- 1 x 39Ω
- 4 x 10μF
- 1 x 1μF
- 220μF
- 1 x 82Ω

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4) Criteria Measurements:

1. Criterion 1:

The current consumption is less than 70mA

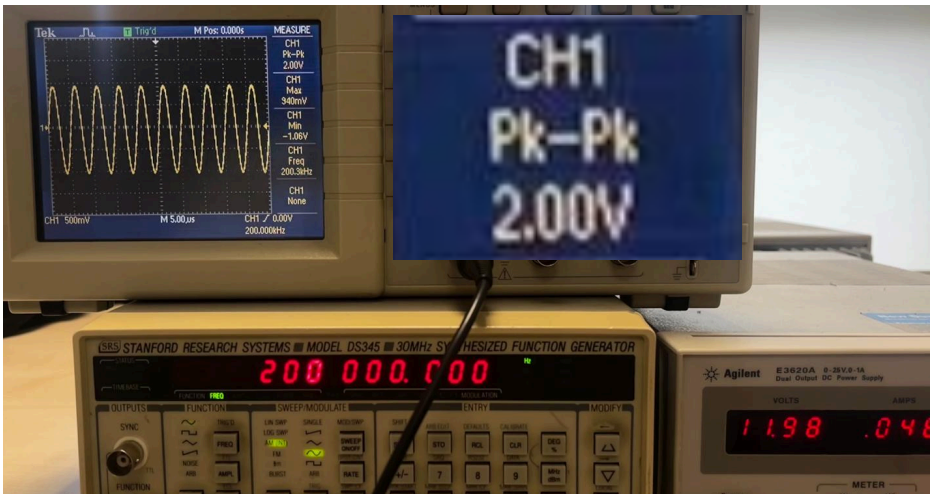

Figure 4.1: 1.96V_{PP}(20dB) at 200kHz with 48mA current consumption

2. Criterion 2:

The bandwidth is at least 2KHz-2MHz while the mid-band gain is 20dB±0.5dB (measure at 2KHz, 200KHz and 2MHz).

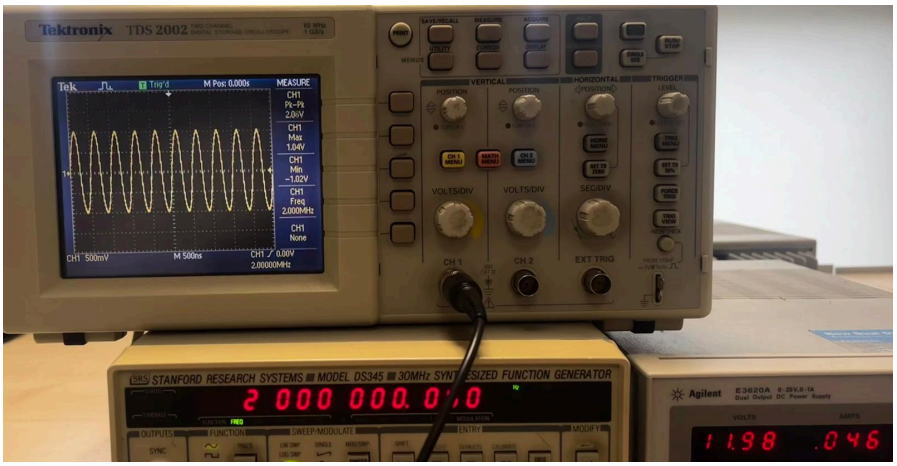

Figure 4.2.1: 2. 06V_{PP}(20.2dB) at 2MHz with 46mA current consumption

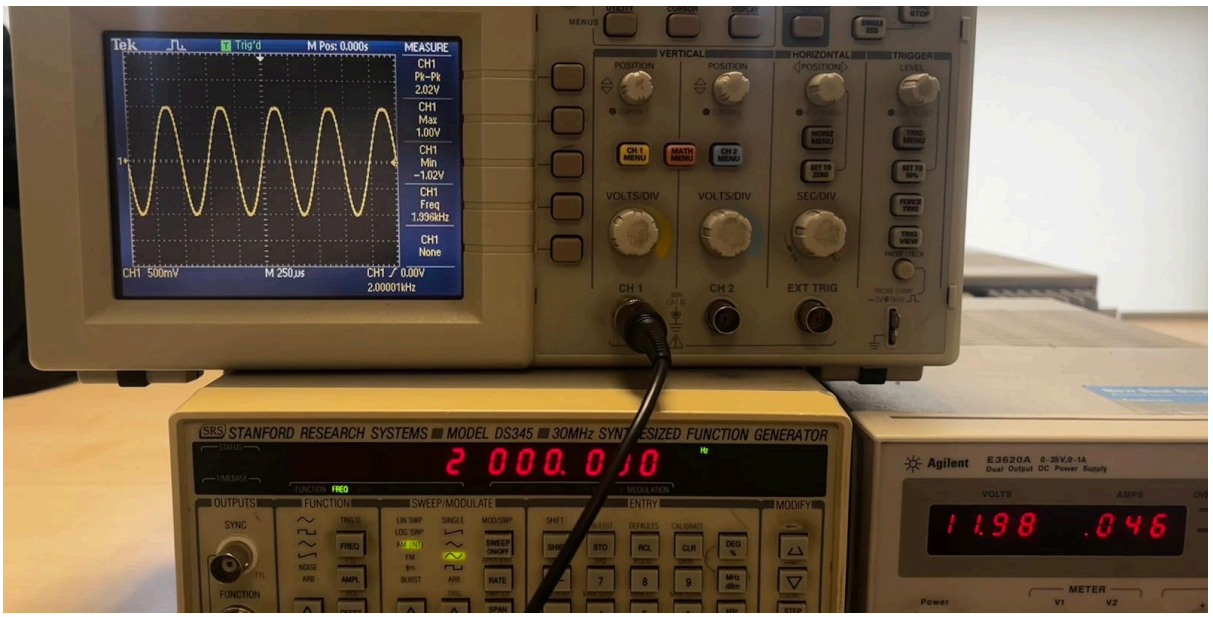

Figure 4.2.2: $2.02V_{PP}$(20.1dB) at 2kHz with 46mA current consumption

3. Criterion 3:

The harmonic content of the output voltage is better than −30dBc at 200KHz.

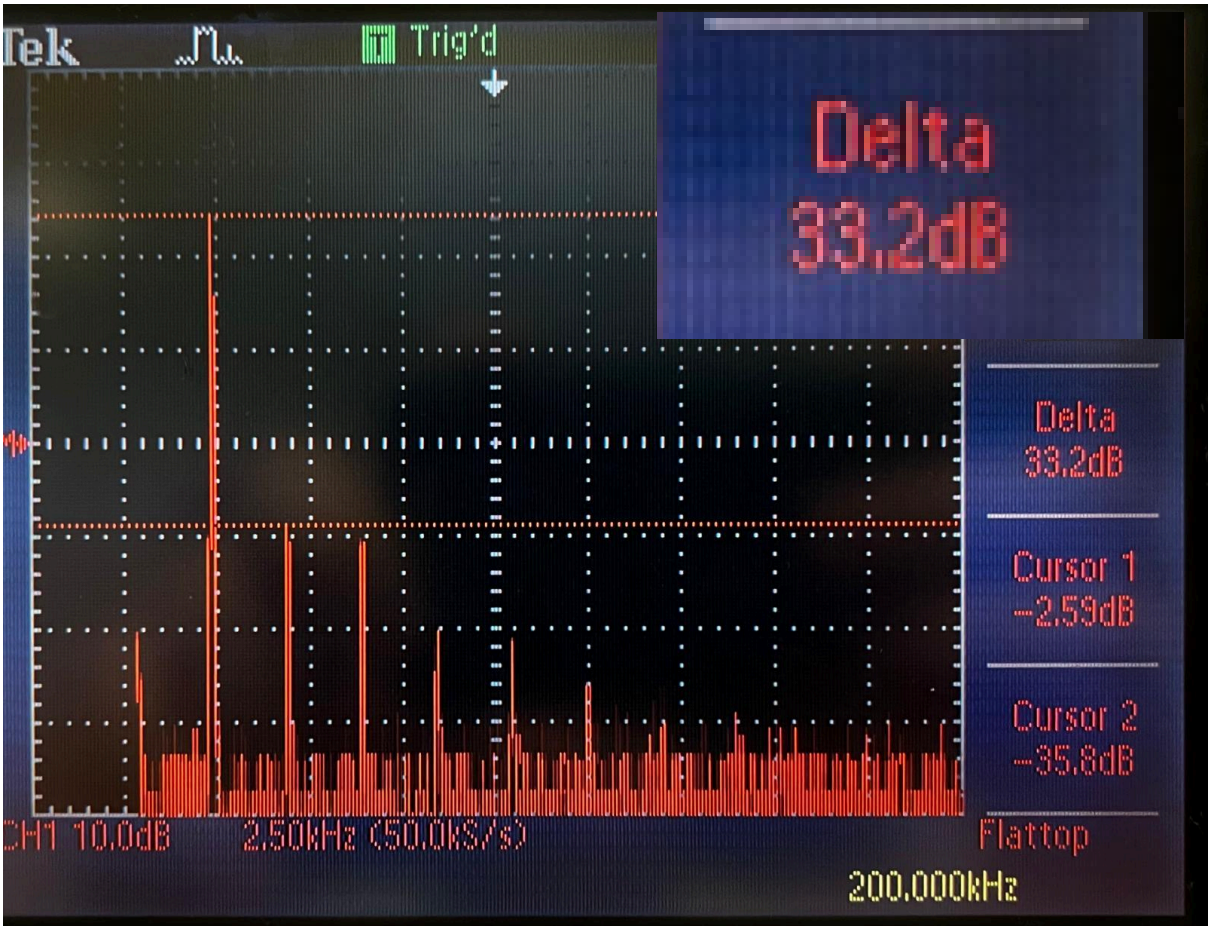

Figure 4.3: FFT of the output voltage

5) Determinations and Measurements:

1. Determination 1:

The small-signal input impedance of the amplifier at 200KHz (with RL=47Ω, adjusted value of RS until the voltage gain drops to half its value compared to RS=0)

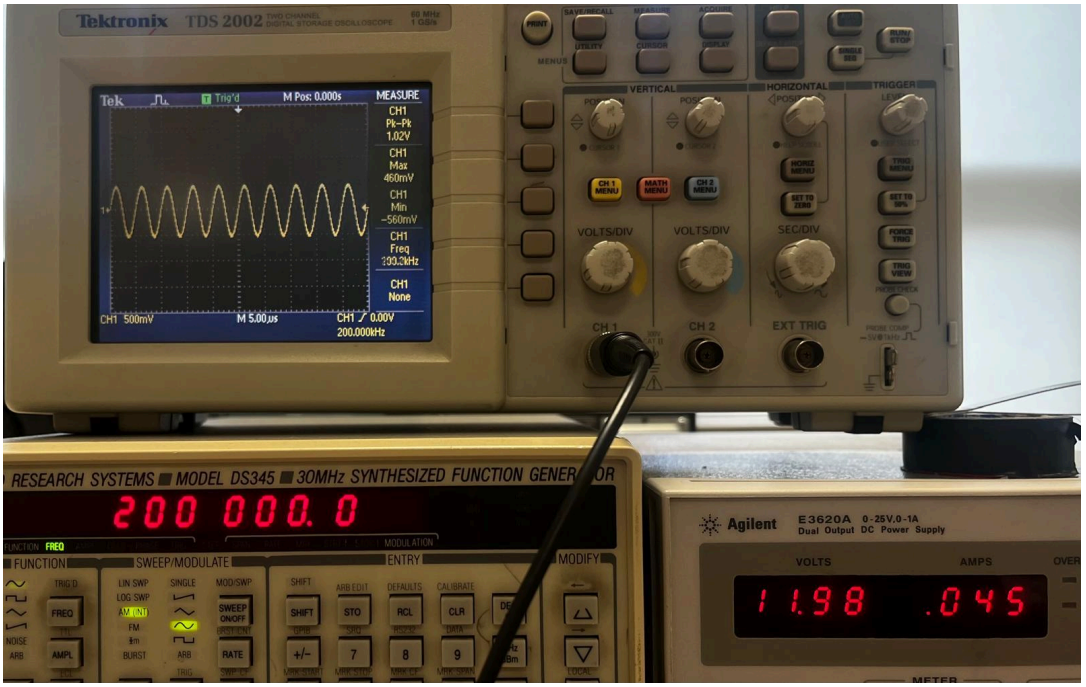

Figure 5.1: Output voltage at half gain

When R_S was chosen as 39kΩ, output voltage was observed to be $1V_{PP}$.

2. Determination 2:

The small-signal output impedance of the amplifier at 200KHz

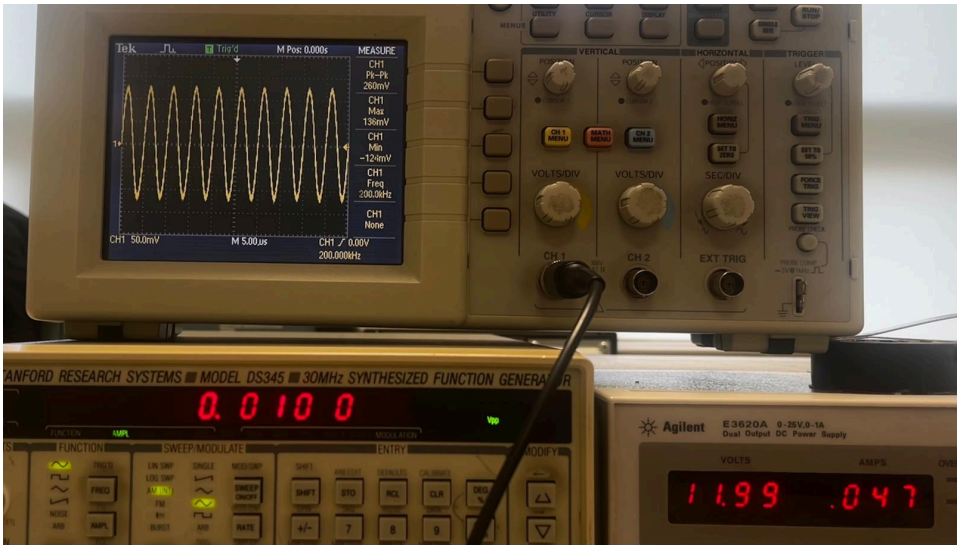

Figure 5.2.1: $260mV_{pp}$ when $V_{in} = 0.02V_{pp}$ and $R_L = \infty$

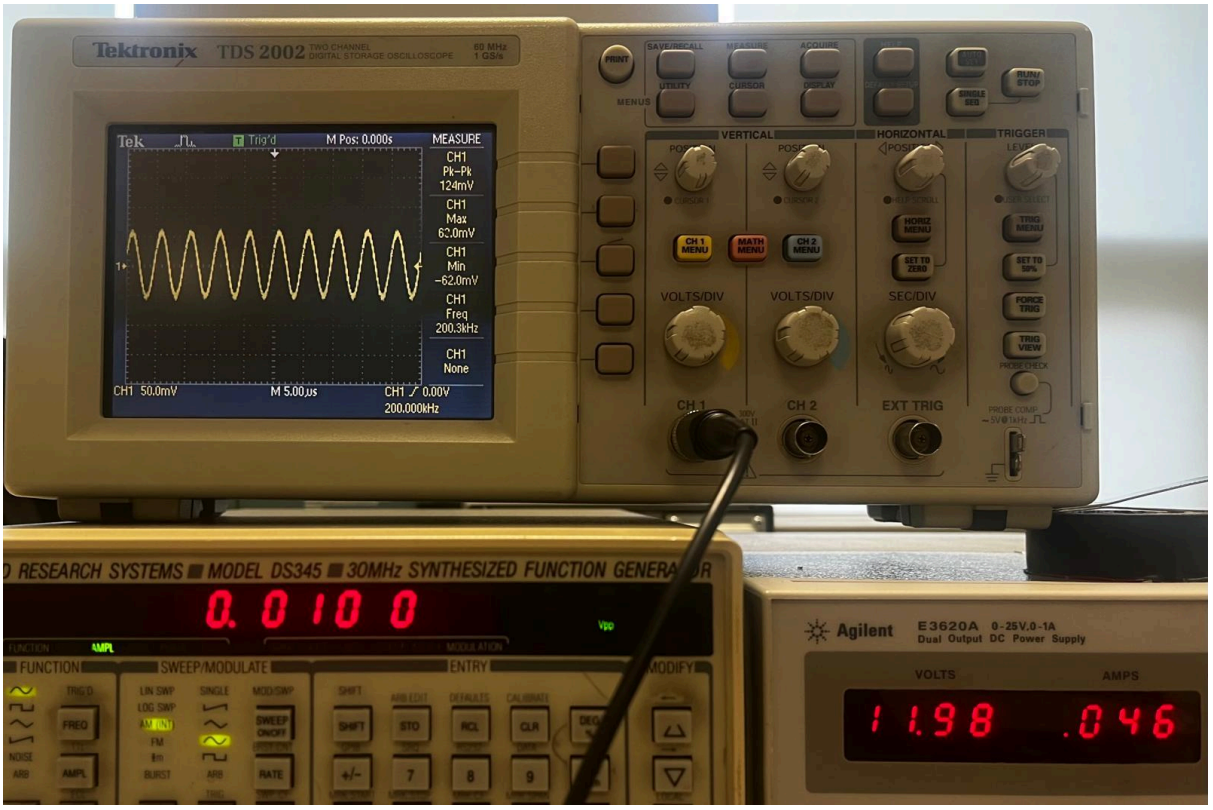

Figure 5.2.1: $124mV_{pp}$ when $V_{in} = 0.02V_{pp}$ and $R_L = 6.8\Omega$

When $R_L = 6.8\Omega$ we observe half the voltage gain with respect to $R_L = \infty$.

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6) Conclusion:

To summarise, the three criteria were satisfied. The circuit has a gain of 20dB at 2kHz, 200kHz, and 2MHz. The amplifier has a band wider than the required band.

- The input impedance was determined to be $39k\Omega$
- The output impedance was determined to be 6.8Ω